Tools and Practices — All the Rest is a Lot

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WHOLE BUILDING DESIGN GUIDE

Office of Management and Budget
The Executive Office of the President

UT-BATTELLE
OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

Premises on This Presentation

- **Mostly can only point you in useful directions**
- **Will cover general resources, agency-specific, and tool-specific**
- **Practices, directives, and tools**
- **Also will touch on what key things this presenter thinks everything else misses**

General Documents

- Whole Building Design Guide
  - (*http://www.wbdg.org*)
- Sustainable Federal Facilities: A Guide to Integrating Value Engineering, Life Cycle Costing, and Sustainable Development, FFC, 2001
  - (*http://books.nap.edu/books/0309072999/html/index.html*)
- LEED, Version 2.1.
  - (*http://www.usgbc.org/ and follow the links)*
- Buying Energy Efficient Products
  - (http://www.eren.doe.gov/femp/procurement)
- OMB Circular A-11
  - *(http://www.whitehouse.gov/omb/circulars/a11/02toc.html)*

General Stuff cont'd

- **You can find sustainability documents all over the internet**
  - **DOE programs, e.g., Rebuild America (*http://www.rebuild.gov*)**
  - **States, cities, counties, school districts**
- **Search Internet using "sustainable new building design" and your favorite other**
  - **1000's of sites**
- **Sustainable? Green? High-Performance?**

Panoply of Tools

- **LEED, SPiRiT, BEEs, Energy Star, BREEAM, GBTool, LCA tools (e.g. ATHENA, ENVEST), . . .**
- **ASHRAE Stds, ISO Stds, ANSI Stds, . . .**
- **Unpublished tools**
- **Proprietary tools**
- **Energy and environmental tools**
- **Occupancy evaluation tools**

Army SPiRiT

- **Dept directive from DAIM, May 4, 2001**
- **Corps of Engineers directive, June 2001**
- **Use SPiRiT for sustainable design**
  http://www.usace.army.mil/inet/usace-docs/eng-tech-ltrs/etl1110-3-491/
- **Instill sustainable design and development into all activities**
- **SPiRiT supposed to blend into LEED 3**

SPiRiT Scoring

Green Results

• Sustainable Sites:	20
• Water Efficiency:	5
• Energy and Atmosphere:	28
• Materials and Resources:	13
• Indoor Environmental Quality:	17

Life-Cycle Synergy

• Facility Delivery Process:	7
• Current Mission:	6
• Future Mission:	4
TOTAL	**100**

US Army Corps of Engineers

Engineer Research & Development Center

Army, USACE, ERDC, CERL

- **Sustainable Design And Development Resource**
  http://www.cecer.army.mil/sustdesign/
- **Lots of info and links, FAQs**
- **Support for process**
- **Info updates**
- **Related resources**

Navy NAVFAC

- **Sustainability policies June 1998**
- **“LEED-like” adopted, July 2002**
  - **Self-assess to LEED Silver required**
  - **Push toward use of non-military standards**
  - **Federal and other related regs considered to be met by compliance with LEED**
- **2003, policy still working its way through the system but definitely being felt**

Air Force

- **Sustainable Facilities Guide, 2001**
- **Sustainability policy, Dec 2001**
  - **LEED is preferred self-assessment metric**
- **Sustainable Development Toolbox**
  - **http://www.afcee.brooks.af.mil/green/resources/toolbox/TOOLBOX.asp**

GSA

- **2000 / 2001 — Sustainable, High-Performance Workplaces a priority**
- **2002/2003 — LEED certification a goal**
- **Longer-Term goal — LEED Silver**
- **High-Performance Workplace research ongoing**

Dept of Energy

- **http://www.sustainable.doe.gov/ (communities)**
- **Interagency sustainability task group**
- **High-performance buildings**
  http://www.eere.energy.gov/buildings/highperformance/
- **Contributes to USGBC**
- **Supports ABSIC, SBIC, etc**

Dept of State

- **If security is your issue, some interesting activities at State, as they struggle to upgrade embassies worldwide**
- **Blast resistance**
- **Chem / bio filtration**
- **On the bleeding edge in some areas**

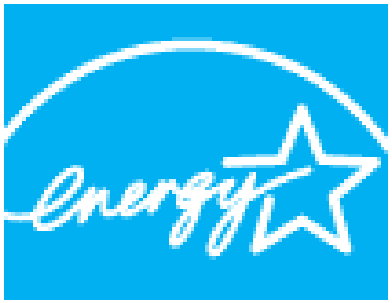
BREEAM Environmental Assessment Method

- **http://www.breeam.com/**
- **The Environmntal Assessement Consortium - EAC**
  - **registered BREEAM consultants**
- **Possibly most widely-used method worldwide**
- **Simple, but somewhat subjective**

BREEAM: 3 sets of issues

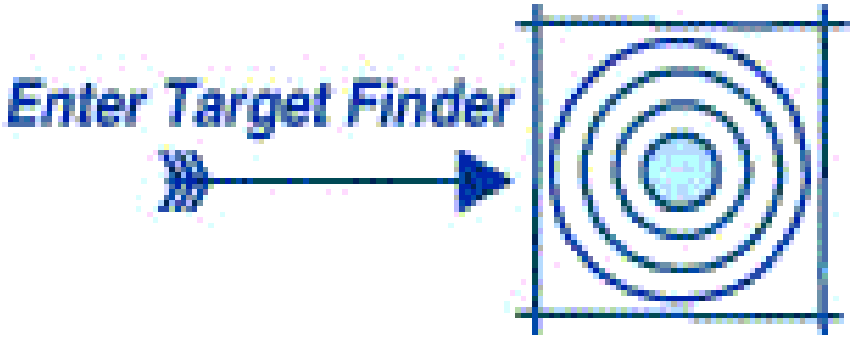
- **Two parts: Building Envelope and Systems, and Operation and Management**
- **Issues for both parts have the same major categories:**
  - **Global Issues**
  - **Local Issues**
  - **Indoor Issues**
- **Before and After approach, occupied state**

Energy Star Buildings



- **EO 13123 directs agencies to "strive" to have facilities become certified**
- **Only truly empirical energy efficiency certification**
- **Five building types: office, hospital, hotel/motel, grocery, K-12 school**
- **Rating tool also required to be integrated into facility audit procedures, EO 13123**

Energy Stars



- **www.energystar.gov**
- **No reason not to use for new buildings, but it requires that**
  - **TOTAL energy use must be estimated**
  - **Estimates must be reasonably accurate**
- **DOE-ORNL has unpublished rating tool that will handle most facilities — even large campuses**

ASHRAE

- **Std 90.1 and 62.1 govern energy systems and indoor air quality in a lot of places**
- **Guideline 18 was supposed to provide more “advanced” energy options, but this Guideline was derailed en route**
- **New Special Project 102 will work to develop an advanced energy approach that is 30% beyond 90.1**
- **New SP 101 will aim for 50% beyond**

Major Common Energy System Issues

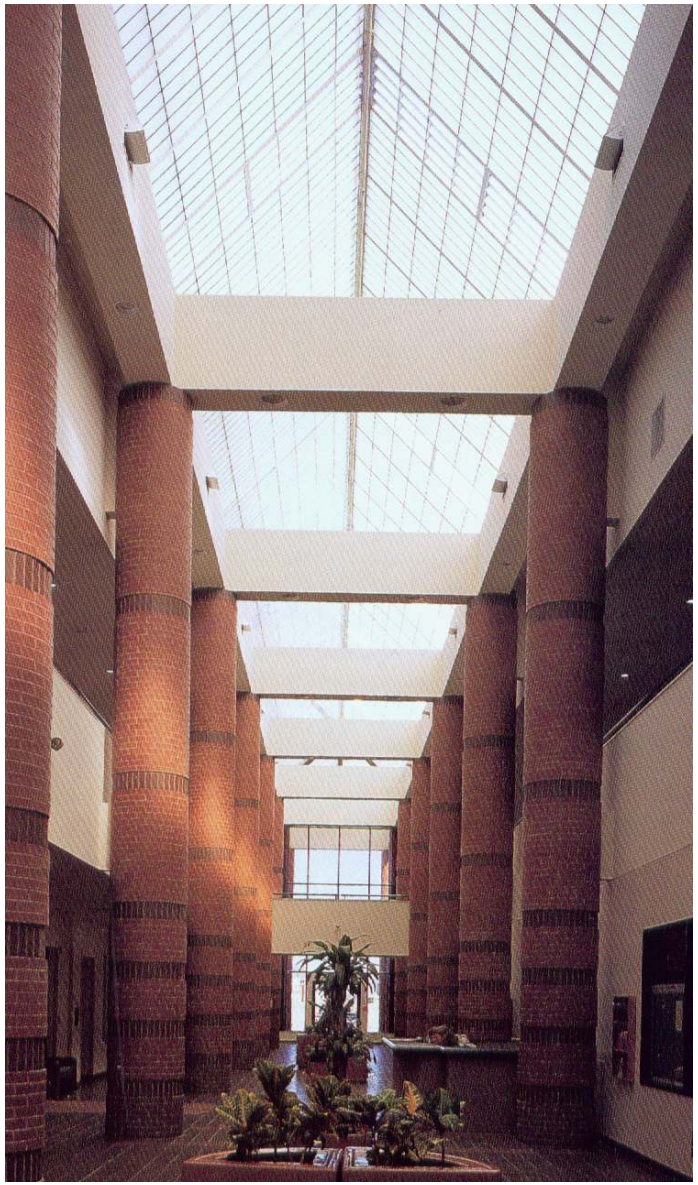
- **Daylighting is still not addressed acceptably in almost all cases, and if used the energy benefits are often negated**
- **Lighting still suffers in many cases**
- **The major innovation in HVAC occurring internationally at this time is splitting the V from the HAC, but only minor recognition in this country**
- **Controls continue to remain inadequate to awful in too many cases**

Design Energy Performance Can Be Specified as Energy Rating

- **One sentence spec and exception to regs and standards covers all that is needed**
- **SPEC: Total building energy use will allow Energy Star certification**
- **EXCEPTION: Energy Star will meet or exceed all other regs, etc**
- **Require end-use breakout estimate, forces care**
- **Has to be a rating system available for the building type**

Daylighting

- **Large energy benefits typically not harvested, 25–40% of lighting energy**
- **Designers typically not aware, codes often against glazing**
- **6–10 key design elements, from orientation and space use to controls, all must be OK to be successful**



Lighting

- **Standards and regs usually out of date, continually trying to catch up**
- **Designs usually boring, and inefficient, as a result**
- **Centralized switching or control of office spaces a disaster, use occupancy sensing**
- **Eliminate HID as much as possible, and use person-sensing as much as possible**
- **Start to link security to sensing of “critters”**

HVAC

- **Split the ‘V’ from HAC, but not necessarily completely**
- **Functions of IAQ, pressurization, exhaust, etc, are complicated and important**
- **HVAC cannot work psychrometrically, 50 years out of date**
- **Occupancy sensing and occupant control are critical**

HVAC Issues

- **VAV is NOT OK for offices and many other types of spaces, OK for 100% outdoor air**
  - **Range of documented problems is staggering**
  - **Makes for lazy zoning in design**
  - **Energy use is 20–25 kBtu/sq-ft higher, average**
- **Airside economizers should not be used, esp in the South — not possible if ‘V’ removed**
  - **Range of problems again staggering**
  - **Pit for O&M dollars, space quality perverter**
  - **Enthalpy recovery or heat recovery instead**

HVAC and Space Quality

- **IAQ quality demands separate IAQ / space pressurization system, and enthalpy recovery becomes more possible**
- **Thermal quality demands small zones and small HAC units for many space types, keep fan pressure and flows down**
- **O&M has to balance HAC unit size, but paradigm of pull and R/R changes game**
- **“Plug-in” racks in the future?**

Space Quality and Design, Basics

- **LEED says “Views,” but a “window” is where the space quality starts, an operable window raises the stakes**
- **The #1 complaint in offices is that the heating and cooling do not work (90% of buildings) — why continue the misery?**
  - **Occupant control critical in most cases**
  - **Occupant sensing the best O&M strategy to have best control**
- **Control of effluents rounds out the basic package**

Controls

- **Let occupancy and presence sensing do most of the work — simplify, simplify, simplify**
- **Simplify the V and HAC so controls are easier**
- **Verification on daylight sensing still needed**
- **Otherwise pay the price of trying to overpower systems with control, and figuring out what the controls are doing**

. . . And in the End . . .

- **Buildings of tomorrow will depend critically on our ability to assess the in-use performance of today's buildings**
  - **High-performance metrics needed**
  - **Assessment methods needed**
- **LEED is awkward for buildings in use (existing)**
- **Energy Star, BREEAM, ANSI/MSE 2000 offer ways to assess buildings in use**
- **But more breadth and empiricism still needed**